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Puerperal symphysis fundus distance: normal values

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Abstract

Aim: To measure puerperal symphysis fundus distance (SFD) by two manual methods and to calculate individual normal values.
Study design: Prospective cohort study including women after single pregnancy without special problems in uterine involution.
Methods: SFD was daily measured on the 1st–5th postpartum days by counting the number of midwife's fingers put horizontally on the mother's abdomen and by a paper tape, respectively. Linear mixed model analysis was performed to determine SFD normal values.
Results: Independent variables determining the SFD on different days after delivery were the gestational age and the delivery mode (finger method) and the maternal age, body mass index (BMI), delivery mode and birth weight (tape method). Individual normal values were calculated by regression equation including the coefficients for the independent variables.
Conclusion: Puerperal SFD values measured by tape have more independent variables than those measured by fingers and reflect better the actual situation of the patient. It should be verified whether values deviating from normal values of tape measurements may prevent postpartum complications.

Keywords: Cesarean section; gestational age; postpartum involution; symphysis fundus distance; vaginal delivery.

Introduction

Postpartum uterine involution reduces the uterine size and returns to non-gravid dimensions toward the end of the second month postpartum. During uterine involution, collagen and elastin decrease immediately. The uterus shrinks from the size of a 20-week gestation to about 350 g by two weeks postpartum. After two weeks, involution continues less rapidly. By three weeks postpartum, the endometrium except the placental area, returns to normal. The placental area returns to normal by the 7th week. Neither retained placental tissue nor moderate infection keeps the non-placental area from regenerating, but retained placenta does prevent involution. The greater the extent of uterine distension during pregnancy, the longer it takes for endometrial regeneration. Higher parity increases the efficiency of uterine involution. Avoiding subinvolution which may be followed by foul-smelling lochia and/or endomyometritis, involution in the early postpartum phase should be monitored daily. Monitoring can be performed estimating the fundal height by manual measurement of the symphysis fundus distance (SFD) [1, 3, 4] and/or by ultrasonographic measurement of the uterine dimension [7–9, 11, 13]. Long-axis measurements correcting for uterine angulations are the most reproducible and accurate, irrespective of bladder distention [13]. There is no measurement more exact than ultrasound, but nonetheless even this is not perfect and the early postpartum uterus is highly susceptible to distortion from trivial pressure applied by the transducer and therefore not really popular. Moreover, ultrasonographic measurements are performed by physicians (in Switzerland), whereas the SFD can be measured by midwifes. Two possibilities for the manual measurement exist: first, by counting the number of midwife's fingers put horizontally on the mother's abdomen to determine the distance (D) between the symphysis pubis (S) and the uterine fundus (F) and second, by a paper tape measure quantifying the number of centimeters from S to F. Based on our experience for many years with the finger method the mean value of a normal involution after single pregnancy is one finger per day. This value corresponding to 1 cm per day is also recommended by Silverton [10]. However, there exists a wide variation between the data of different studies or recommendations. The WHO recommends 2 cm per day. In a study comparing the postpartum involution in mothers with vs. without the administration of methylergometrine [1, 14] found a mean value of 2.2 cm in four days corresponding to 0.5 cm per day (pregnancies not selected by parity, delivery mode or number of neonates). In a small study with 28 primiparas, Cluett et al. [4] measured the SFD daily within the first 18 days after delivery by a paper tape on which they have marked the distance with a pen. The distance was measured afterwards in cm with a tape measure. In 22 (78.6%) patients the involution did not decrease linearly but included a phase with a delayed involution of <1 cm in three days.

In contrast to the pregnancy SFD for which different normal curves exist, no such curves exist for postpartum involution. It was therefore the objective of the present study to produce normal values for the first days after delivery in a cohort of mothers which gave birth at our department. SFD measurements in all mothers were carried out by manual

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palpation using the fingers as well as the paper tape measure. Data were evaluated in relation to the method, parity, gestational age, maternal age, weight and height and the delivery mode.

Methods

Women with a live born infant after single pregnancy were consecutively recruited from admissions to the Department of Obstetrics, Zurich University Hospital, during four months. All provided written informed consent for the study which was approved by the local Institutional Review Board. Exclusion criteria were women with multiple pregnancy, stillbirth and fetal malformations. Patients with signs or symptoms of uterine subinvolution (prolonged lochia, profuse vaginal bleeding, large and flabby uterus or the need of oxytocic medication) on day 2–5 were secondarily excluded.

All measurements were carried out by midwifes daily between 8:00 and 11:00 a.m. during postpartum hospital stay at least until the 5th postpartum day. The women with an empty bladder had to lie down in the supine position with their arms and legs straight. During measurements the women were not allowed to breastfeed. Manual measurements in each women were performed by two different methods: (1) the midwife placed one or more than one finger horizontally on the woman's abdomen to estimate the fundus above or below the navel (finger methods); (2) the midwife placed one end of a white tape on the patient's symphysis pubis bone and marked the top of the uterus on it. The distance on the tape was afterwards measured by a measure tape giving the SFD in cm (tape method). At every timepoint only one measurement was carried out and measurements in one woman were not performed always by the same midwife taking into account the real clinical situation. On every day the degree of nursing (no, partial, full) was recorded.

Patient data including the maternal age, weight and height, parity, gestational age and the number of neonates were obtained from the patient notes. The SFD data as well as the data of the degree of nursing were collected daily. All data were given in an Excel file. The primary endpoint was to define independent variables influencing postpartum SFD measured by both methods. The secondary endpoints were to define the equation for calculating individual SFD values and to show practical examples of values calculated by this method.

The data were analyzed in StatView 5.0.1 for Windows XP. Mean, standard deviation (SD), standard of the mean, range and median were calculated. Linear mixed model analysis and a post hoc power analysis were performed by SPSS Version 16. $P<0.05$ was considered significant.

Results

A total of n = 509 was selected from 550 women who were delivered during 18 weeks. Most women were Caucasians (n = 433; 85%), a minority was Africans (4.5%), Asians (2.5%) and Latinos or Orientals (= 8% others; Table 1). A total of 47.8% were multiparae and 60.5% had a vaginal delivery. In the case of cesarean section there was no failure in measuring uterine size in any woman. Mean gestational age at delivery was 38.5 weeks, however, 79 newborns (15.5%) were preterm. At day 3 only 14 women (3.7%) did not nurse their baby because of a contraindications (HIV infections).

Table 1 Demographic data (n = 509).

Age (years)	29.7 ± 5.6
Height (m)	1.6 ± 0.07
Weight* (kg)	62.2 ± 11.1
BMI* (kg/m^2)	22.99 ± 4.01
Gravidity > 1 (n)	287
Nulliparity (n)	273
Caucasian (n)	433
African (n)	23
Asian (n)	13
Others (n)	40
Gestational age at delivery (weeks)	38.5 ± 2.8
Preterm delivery (< 37.0 weeks) (n)	79
Vaginal delivery (n)	308
Cesarean section (n)	201
Birth weight (g)	3184 ± 37
Sex male/female (n)	253/256
Degree of nursing at 3rd postpartum day (%)	
No	3.7
Partially	63.6
Full	32.7

*Before pregnancy i.e., < 7.0 weeks of gestation.
Continuous values: mean ± SD (n); n = numeric values, BMI = body mass index, SD = standard deviation.

The post hoc power analysis considering a relevant difference in SFD of 2 cm (SD = 2.5) between women with vaginal delivery and cesarean section measured by tape

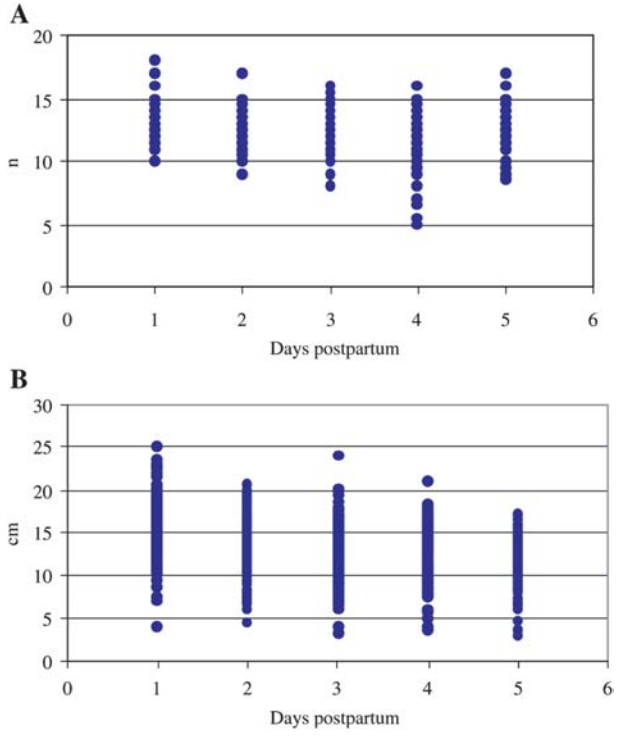

Figure 1 Scattergram showing individual values of symphysis fundus distance measured daily in 509 women after delivery during postpartum hospital stay until the 5th postpartum day A by finger (n) and B by tape (cm).

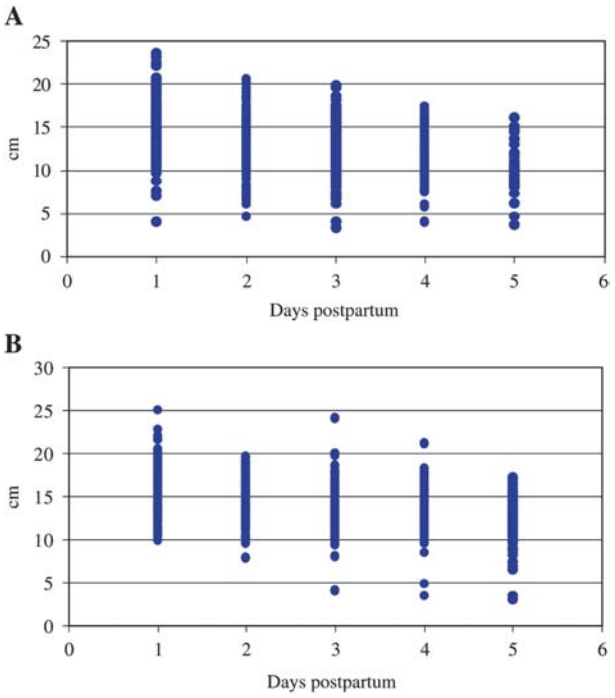

Figure 2 Scattergram showing individual values of symphysis fundus distance measured daily by tape (cm) in women during postpartum hospital stay until the 5th postpartum day A after vaginal delivery (n = 308) and B after cesarean section (n = 201).

resulted in a power of 0.8 (n = 20) and 1.0 (n = 200), respectively.

SFD values measured by fingers and by tape, respectively, are given in Figure 1. Values are higher after cesarean than after vaginal delivery on every day and involution is slower after cesarean (Figure 2). Multiple linear regression by mixed model analysis discovered the significant influence of the gestational age, the delivery mode and the day postpartum in the finger method (Table 2). If the tape was used, significant independent variables were the maternal age, body mass index (BMI), delivery mode, fetal birth weight and the day postpartum (Table 2). No influence could be shown for parity, gravidity, fetal sex and degree of nursing. The regression equation including these predictors can be used to calculate mean (50th centile) SFD values within the first five postpartum days. Values for the 5th and the 95th centiles were created by correction of the mean value (Table 3).

Table 3 Multiple regression equations to calculate norm postpartum SFD values for the 50th, 5th and 95th centile, respectively.

Centile	Equation
Finger	
50th	11.0009 + 0.0592 × gestational age (week) + 0.6760 × delivery mode (*) – 0.5233 × day p.p (n)
5th	50th – 1.645 × 0.6062
95th	50th + 1.645 × 0.6062
Tape	
50th	7.3226 + 0.0467 × age (year) + 0.0636 × BMI (kg/m^2) + 1.2709 × delivery mode (*) + 0.0006 × birth weight (g) – 0.9262 × day p.p (n)
5th	50th – 1.645 × 2.7827
95th	50th + 1.645 × 2.7827

*0 for vaginal delivery, 1 for cesarean section.
BMI = body mass index; SFD = symphysis fundus distance.

Examples for SFD values estimated from the regression equations related to the postpartum days are given for tape measuring in 20-year-old women with a BMI of 17 and in 40-year-old women with a BMI of 30 once after vaginal delivery and once after cesarean section, respectively (Figure 3).

Discussion

We showed that SFD measured by two different types of manual methods i.e., by fingers and by tape, are not influenced by the same independent variables. However, for each

Table 2 Mixed model analysis of independent variables and the dependent variable SFD recorded by finger or tape, respectively.

Variable	Coefficient	SE	P-value	95% Confidence interval
Finger				
Age	0.003775	0.007757	0.627	–0.011465 to 0.019016
BMI	0.013027	0.010857	0.231	–0.008305 to 0.034359
Gestational age	0.059154	0.024162	**0.015**	0.011681 to 0.106627
Delivery mode	0.675995	0.091851	**0.000**	0.495527 to 0.856463
Birth weight	0.000103	0.0000916	0.262	–0.0000771 to 0.000283
Day p.p.	–0.523272	0.014633	**0.000**	–0.551975 to –0.494568
Tape				
Age	0.046717	0.015917	**0.003**	0.015440 to 0.077993
BMI	0.063640	0.022218	**0.004**	0.019983 to 0.107296
Gestational age	0.086566	0.049065	0.078	–0.009845 to 0.182976
Delivery mode	1.270855	0.188259	**0.000**	0.900946 to 1.640764
Birth weight	0.000630	0.000187	**0.001**	0.000263 to 0.000997
Day p.p.	–0.926229	0.032872	**0.000**	–0.990712 to –0.861745

BMI = body mass index, SE = standard error, SFD = symphysis fundus distance.

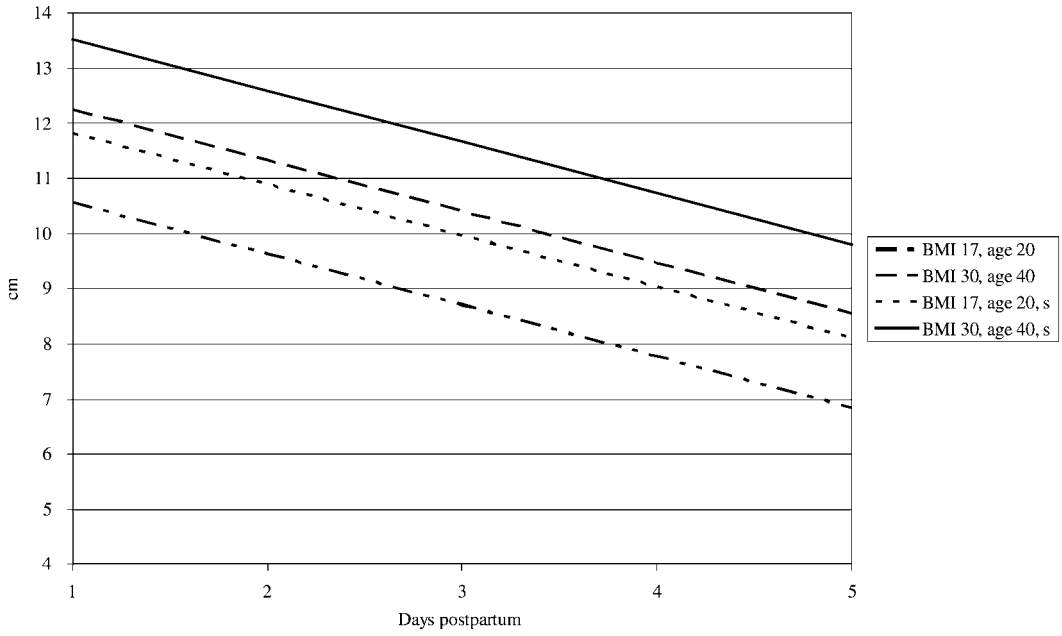

Figure 3 Example of individual puerperal symphysis fundus distance measured by tape (cm) related to the first five postpartum days for four women with different predictors (independent variables) as: age 20 and BMI 17; age 40 and BMI 30; both without or with cesarean section(s).
BMI = body mass index.

postpartum day the delivery mode is a variable which plays a key role in both methods. There are more variables detected by mixed model analysis influencing the values if measurements are performed by tape than by finger. Individual normal values can be calculated from the regression equation including these variables.

This is the first cohort study with sufficient statistical power demonstrating normal values for postpartum SFD measured by two manual methods to estimate uterine involution. In contrast to the measurement of fundal height in pregnancy, until now, only a small number of studies addressed the measurement of postpartum fundus. It includes a smaller number of women than in our study [1, 3, 4] and/or focused on ultrasonographic (US) measures [7, 8, 11, 13] or compared manual with US measures [9]. However, our results agree with those of Arabin et al. [1] who demonstrated faster uterine involution after vaginal delivery than after cesarean. In addition, it agrees with those of Cluett et al. 1997 [4] who showed a faster involution on day 1 than on the following days. These observations are in contrast to the recommendation of the WHO indicating independently of the day a mean involution (difference of SFD) of 2 cm.

In contrast to the ultrasonographic measurements [13] we were unable to relate between involution and parity, i.e., we could not find faster involution with higher parity. Moreover, our results show new information on the maternal age which is a variable determining the SFD measured by tape: the fundus is lower (mean difference 0.5 cm immediately after delivery) and the involution is faster in a 20-year-(30-year-) old than in a 30-year-(40-year-, respectively) old woman irrespective of the delivery mode.

We have not undertaken repeated measurement (by the same person on the same day) assuming that measurement taken <2 min apart would not have significant differences and would not also be accepted by the patient. Moreover, this design is reflecting the real clinical situation. Manual methods for measuring SFD are influenced by inter-individual variation of the investigator and the flexibility of the uterus [13]. For the tape measurement on a special postpartum day there exist four additional independent variables influencing the values. We assume therefore that the tape measurement is reflecting the actual situation of an individual woman on each postpartum day more accurately than that of the finger method. The tape measurement is therefore the elective method for and the estimation of individual normal values. Regression equations should be added to the software of the electronic patient files, where centiles can be calculated from daily measured values. Values over the 95th centile are considered to be pathological indicating subinvolution. Subinvolution is a postpartum complication which is followed by infection, blood loss and hysterectomy if it is not detected and/or treated [2, 5]. Subinvolution was treated for many years with methylergometrine, which has several disadvantages. The prostaglandin E analogue misoprostol, recommended for preventing postpartum hemorrhage [12], could be an alternative [6]. However, earlier data could not detect a relationship between decreased involution and complications [3, 4]. For further clinical significance it should therefore be verified whether tape measurement which is a cheap and non-invasive method, is the preferred method for preventing postpartum complications or adverse outcomes.

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